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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

EEN4206 – SEMICONDUCTOR PACKAGING AND TEST
(ME/RE/TE)

20 OCTOBER 2018

2:30pm – 4:30pm

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 3 pages with 4 Questions only.
2. Attempt **ALL (4)** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1 [25 marks]

(a)(i) Who are the top two semiconductor manufacturing leaders consistently over the past three years in microelectronics industry? Where does Infineon stand for year 2018? [2 + 1 marks]

(ii) What is the main boom in semiconductor technology from year 2017 to year 2018? [2 marks]

(iii) What is deemed as death of Moore's Law? Briefly explain an alternative technology in pushing the semiconductor industry's growth. [2 marks]

(b)(i) Define Semiconductor Packaging. [2 marks]

(ii) Sketch and label the six key components of IC Packaging with the aid of 2-dimension diagram. [6 marks]

(c)(i) What are the two main challenges in today's power packaging in system application? [2 marks]

(ii) What are the potential components that can be integrated today in a complex system such as in a Double Clutch Transmission system? [3 marks]

(d)(i) List the process flow of IC manufacturing from Pre-Assembly to final TMSP. [3 marks]

(ii) What are the four processes involving in IC packaging before shipping the products to the customers? [2 marks]

Continued...

Question 2 [25 marks]

(a) Briefly describe the following die attach processes:

- (i) Adhesive die attach [2 marks]
- (ii) Solder paste die and clip attach [2 marks]
- (iii) Eutectic/Diffusion solder die attach [2 marks]

(b) Explain the key characteristics of the following solder materials in achieving an optimum soldering process:

- (i) Solder wire material [3 marks]
- (ii) Solder paste material [3 marks]

(c) In an event of the mold compound material is not stored properly inside the cold room with the desire temperature (i.e. temperature is too high), what will be the potential failure mode on the molded package? You can explain it with the aid of diagram for the failure mode. [4 marks]

(d) A mold compound has following measurement values at room temperature.

Mold length: 25 mm

EMC test piece: 15 mm

Post cured test piece length: 18 mm

- (i) Calculate mold shrinkage and total mold shrinkage percentage. [4 marks]
- (ii) Based on the results in part (i), discuss two methods that can be implemented to optimize the shrinkage percentage. [5 marks]

Question 3 [25 marks]

(a) Explain the wire bonding process in microelectronic industry. [2 marks]

(b) Describe the bonding cycle for thermosonic ball bonding with illustration. [8 marks]

(c) What are the four major roles of product and test engineering in microelectronic industry? [4 marks]

(d)(i) Explain the meaning of Nano-technology. [2 marks]

(ii) What are the six major wafer fabrication processes? [6 marks]

(iii) Illustrate the photomask process with a diagram. [3 marks]

Continued...

Question 4 [25 marks]

(a)(i) Describe five common wafer defects in microelectronic industry. [5 marks]

(ii) What is delamination in integrated circuits (ICs)? [2 marks]

(b) In ultrasonic inspection, a sample as shown in the Figure Q4 was scanned. Calculate the value of reflection coefficients R_1 and R_2 . Given the impedances of the materials in the table below:

Material	Impedance, $Z (\times 10^6 \text{ kg/m}^2\text{s})$
Water	1.5
Mold Compound	6.8
Silicon	20.0
Copper	42.0

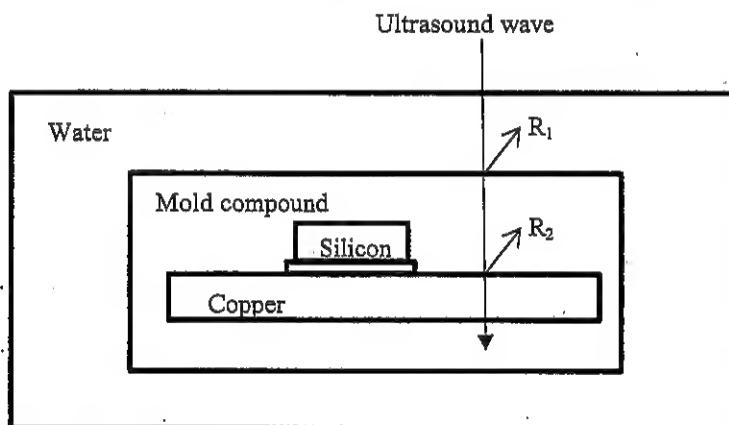


Figure Q4

[5 marks]

(c) Describe the procedures of hot spot analysis using liquid crystal thermography (LCT). [7 marks]

(d)(i) Define Peck Model. [2 marks]

(ii) If test condition for H3TRB is $85^\circ\text{C}/90\% \text{ RH}$ and the normal operating condition of $50^\circ\text{C}/30\% \text{ RH}$. Calculate the acceleration factor by humidity when $n = 3$. [2 marks]

(iii) If the total acceleration factor by humidity acceleration and temperature acceleration is $AF(RH, T) = 8760$ and the stress duration is 1000 hours, estimate the lifetime of the device at use condition. [2 marks]

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